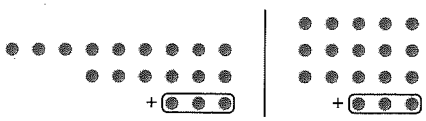
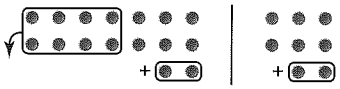
Sample Solutions

1. a)



$15 + 3 = 15 + 3$

b)

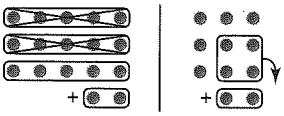


$6 + 2 = 6 + 2$

c)

$10 + 2 = 10 + 2$

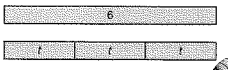
d)



For clarity, only 1 group of 5 is shown on the left side.

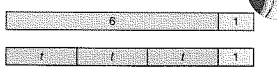
$5 + 2 = 5 + 2$

➤ Suppose we know $6 = 3t$.
We can model this equation with paper strips.

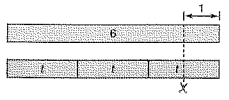


To preserve the equality, we can:

- Add the same number to each side.
  So, $6 + 1 = 3t + 1$

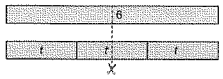


- Subtract the same number from each side.
  So, $6 - 1 = 3t - 1$



- Multiply each side by the same number.
  So, $2 \times 6 = 2 \times 3t$

- Divide each side by the same number.
  So, $6 \div 2 = 3t \div 2$



When we do the same to each side of an equation, we produce an **equivalent form of the equation.**

So,
$6 + 1 = 3t + 1$
$6 - 1 = 3t - 1$
$2 \times 6 = 2 \times 3t$
$6 \div 2 = 3t \div 2$
} are all equivalent forms of the equation $6 = 3t$.

Practice

1. For each equation below:
   - Model the equation with counters.
   - Use counters to model the preservation of equality for addition.
   - Draw a diagram to record your work.
   - Use symbols to record your work.

   a) $9 + 6 = 15$ b) $14 - 8 = 6$
   c) $2 \times 5 = 10$ d) $15 \div 3 = 9 - 4$

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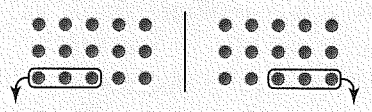
Unit 1 Lesson 2

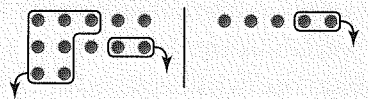
(Sample Solutions continue below, left.)

2. a)



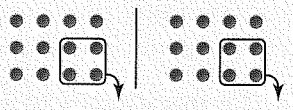
$15 - 3 = 15 - 3$

b)



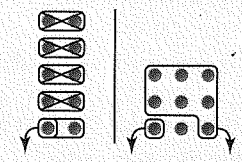
$5 - 2 = 5 - 2$

c)



$12 - 4 = 12 - 4$

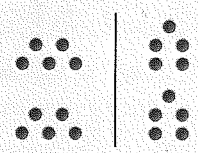
d)



For clarity, only 1 group of 2 is shown on the left side.

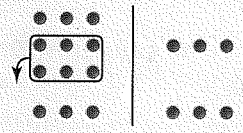
$2 - 1 = 2 - 1$

3. a)



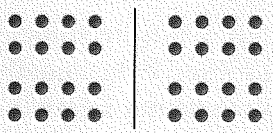
$5 \times 2 = 5 \times 2$

b)



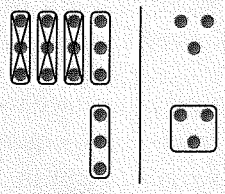
$3 \times 2 = 3 \times 2$

c)



$8 \times 2 = 8 \times 2$

d)



$3 \times 2 = 3 \times 2$

For clarity, only 1 group of 3 is shown on the left side.

2. For each equation below:
   - Model the equation with counters.
   - Use counters to model the preservation of equality for subtraction.
   - Draw a diagram to record your work.
   - Use symbols to record your work.

   a) $7 + 8 = 15$ b) $12 - 7 = 5$
   c) $3 \times 4 = 12$ d) $10 \div 5 = 9 - 7$

3. For each equation below:
   - Model the equation with counters.
   - Use counters to model the preservation of equality for multiplication.
   - Draw a diagram to record your work.
   - Use symbols to record your work.

   a) $2 + 3 = 5$ b) $9 - 6 = 3$
   c) $2 \times 4 = 8$ d) $12 \div 4 = 2 + 1$

4. For each equation below:
   - Model the equation with counters.
   - Use counters to model the preservation of equality for division.
   - Draw a diagram to record your work.
   - Use symbols to record your work.

   a) $5 + 1 = 6$ b) $8 - 4 = 4$
   c) $5 \times 2 = 10$ d) $16 \div 2 = 2 \times 4$

2-3

5. For each equation below:
   - Apply the preservation of equality. Write an equivalent form of the equation.
   - Use paper strips to check that equality has been preserved.

   Try to use a different operation for each part.

   a) $3b = 12$ b) $2t = 8$
   c) $16 = 4s$ d) $15 = 5s$

   How do you know that equality has been preserved each time?

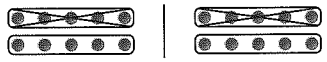
Reflect

Talk to a partner. Tell your partner what you think the preservation of equality means. Describe how you could model the preservation of equality for each of the 4 operations.

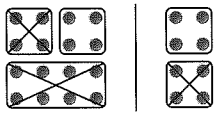
4. a)  $6 \div 3 = 6 \div 3$

   b)  $4 \div 2 = 4 \div 2$

   For clarity, only 1 group of 2 is shown on each side.

   c)  $10 \div 2 = 10 \div 2$

   For clarity, only 1 group of 5 is shown on each side.

   d)  $8 \div 2 = 8 \div 2$

   For clarity, only 1 group of 4 is shown on each side.

5. I know that equality has been preserved because I did the same thing to both sides of the equation each time. Students' answers should include drawings of paper strips.

REFLECT: Preservation of equality means keeping equations balanced by doing the same to each side of an equation. I can use counters and paper strips to show that I can add, subtract, multiply, or divide in the same way on both sides of an equation and equality is preserved.

ASSESSMENT FOR LEARNING

What to Look For

Conceptual Understanding

✔ Students can explain that equality is preserved when both sides of an equation are changed in the same way.

✔ Students can explain that preservation of equality applies to equations that contain variables.

Procedural Knowledge

✔ Students can write equivalent forms of an equation.

✔ Students can use models to explain preservation of equality.

What to Do If You Don't See It

Check Further

- Is this equation balanced? How do you know?
- What will happen if we add 4 to one side of the equation?
- How could we re-balance the equation?
- How can we check that our new equation is balanced?

Adjust Instruction

Have students work with a partner. One student is the "equation changer" while the other student is the "preserver of equality." The "changer" applies a number and operation to one side of an equation. The "preserver" must match this change to keep the equation balanced. Have students switch roles.